What Is Claimed Is:

1. A method for discovering remote nodes in an Ethernet passive optical network which includes a central node and at least one remote node, wherein downstream data from the central node is broadcast to the remote nodes, and wherein upstream data from each remote node is transmitted to the central node in a unicast manner, the method comprising:

receiving a solicitation message from the central node, wherein the solicitation message includes a time stamp indicating the solicitation message's transmission time and assigns a starting time and size for a discovery slot in which the remote node is allowed to transmit a response message to the central node for registration;

setting a local time at the remote node according to the received time stamp; and

after a random delay from the beginning of the discovery slot, transmitting the response message to the central node during the discovery slot with a response transmission probability that is less than or equal to one.

2. The method of claim 1, further comprising setting the value of the response transmission probability according to how many times the remote node has failed in registering with the central node.

3. The method of claim 2, wherein the value of the response transmission probability is $C_f^{-(j-1)}$, where

j is the number of previously failed registration attempts by the remote node; and

C_f is a positive number greater than 1.

4. The method of claim 1, wherein the central node sets the value of the response transmission probability and specifies the response transmission probability within the solicitation message.

5. The method of claim 4, further comprising

setting the value of the response transmission probability according to the maximum number of undiscovered remote nodes that may transmit response messages for registration with the central node;

wherein the maximum number of undiscovered remote nodes that may transmit response messages decreases as the number of discovered remote nodes increases in an EPON with fixed maximum number of allowable remote nodes.

6. The method of claim 1, further comprising

setting the size of the discovery slot according to the maximum number of undiscovered remote nodes that may transmit response messages for registration with the central node;

wherein the maximum number of undiscovered remote nodes that may transmit response messages decreases as the number of discovered remote nodes increases in an EPON with fixed maximum number of allowable remote nodes.

7. The method of claim 6, wherein the size of the discovery slot is proportional to the maximum number of undiscovered remote nodes that may transmit response messages, and is also proportional to transmission busy time of the response message.

8. The method of claim 7, wherein the size of the discovery slot is precisely or approximately equal to $C_s \times n \times T$, where

C_s is a positive number;

n is the maximum number of undiscovered remote nodes that may transmit response messages; and

T is the transmission busy time of the response message.

9. The method of claim 8, further comprising

storing values of the size of the discovery slot in a table based on different maximum numbers of undiscovered remote nodes that may transmit response messages; and

before sending out the solicitation message, retrieving a value of the size of the discovery slot based on the current maximum number of undiscovered remote nodes that may transmit response messages.

10. The method of claim 6, wherein size of the discovery slot is approximately:

$$\frac{T \cdot (2n-1) + \sqrt{T^2 \cdot (2n-1)^2 + 8 \cdot T \cdot E \cdot (n-1)}}{2}$$; where

T is the transmission busy time of the response message;

n is the maximum number of undiscovered remote nodes that may transmit response messages; and

E is the maximum round-trip propagation delay between the central node and any remote node.

11. The method of claim 10, further comprising

storing values of the size of the discovery slot in a table based on different maximum numbers of undiscovered remote nodes that may transmit response messages; and

before sending out the solicitation message, retrieving value of the size of the discovery slot based on the current maximum number of undiscovered remote nodes that may transmit response messages.

12. The method of claim 6, wherein size of the discovery slot is approximately:

$n \cdot T + \sqrt{n^2 \cdot T^2 + 2 \cdot T \cdot E \cdot (n-1)}$; where

T is the transmission busy time of the response message;

n is the maximum number of undiscovered remote nodes that may transmit response messages; and

E is the maximum round-trip propagation delay between the central node and any remote node.

13. The method of claim 12, further comprising

storing values of the size of the discovery slot in a table based on different maximum numbers of undiscovered remote nodes that may transmit response messages; and

before sending out the solicitation message, retrieving value of the size of the response transmission period based on the current maximum number of undiscovered remote nodes that may transmit response messages.

14. An apparatus for discovering remote nodes in an Ethernet passive optical network, comprising:

a central node;

at least one remote node that is configured to,

receive a solicitation message from the central node, wherein the solicitation message includes a time stamp indicating the solicitation

message's transmission time and assigns a starting time and size for a discovery slot in which the remote node is allowed to transmit a response message to the central node for registration;

set a local time at the remote node according to the received time stamp; and

after a random delay from the beginning of the discovery slot, transmit the response message to the central node during the discovery slot with a response transmission probability that is less than or equal to one;

wherein downstream data from the central node is broadcast to the remote nodes, and wherein upstream data from each remote node is transmitted to the central node in a unicast manner.

15. The apparatus of claim 14, wherein the remote node is further configured to set the value of the response transmission probability according to how many times the remote node has failed in registering with the central node.

16. The apparatus of claim 15, wherein the value of the response transmission probability is $C_f^{-(j-1)}$, where

j is the number of previously failed registration attempts by the remote node; and

C_f is a positive number greater than 1.

17. The apparatus of claim 14, wherein the central node is configured to set the value of the response transmission probability and specifies the response transmission probability within the solicitation message.

18. The apparatus of claim 17, wherein the central node is further configured to,

set the value of the response transmission probability according to the maximum number of undiscovered remote nodes that may transmit response messages for registration with the central node;

wherein the maximum number of undiscovered remote nodes that may transmit response messages decreases as the number of discovered remote nodes increases in an EPON with fixed maximum number of allowable remote nodes.

19. The apparatus of claim 14, wherein the central node is configured to,

set the size of the discovery slot according to the maximum number of undiscovered remote nodes that may transmit response messages for registration with the central node;

wherein the maximum number of undiscovered remote nodes that may transmit response messages decreases as the number of discovered remote nodes increases in an EPON with fixed maximum number of allowable remote nodes.

20. The apparatus of claim 19, wherein the size of the discovery slot is proportional to the maximum number of undiscovered remote nodes that may transmit response messages, and is also proportional to transmission busy time of the response message.

21. The apparatus of claim 20, wherein the size of the discovery slot is precisely or approximately equal to $C_s \times n \times T$, where

C_s is a positive number;

n is the maximum number of undiscovered remote nodes that may transmit response messages; and

T is the transmission busy time of the response message.

22. The apparatus of claim 21, wherein the central node is further configured to,

store values of the size of the discovery slot in a table based on different maximum numbers of undiscovered remote nodes that may transmit response messages; and

before sending out the solicitation message, retrieve a value of the size of the discovery slot based on the current maximum number of undiscovered remote nodes that may transmit response messages.

23. The apparatus of claim 19, wherein size of the discovery slot is approximately:

$$\frac{T \cdot (2n-1) + \sqrt{T^2 \cdot (2n-1)^2 + 8 \cdot T \cdot E \cdot (n-1)}}{2}$$; where

T is the transmission busy time of the response message;

n is the maximum number of undiscovered remote nodes that may transmit response messages; and

E is the maximum round-trip propagation delay between the central node and any remote node.

24. The apparatus of claim 23, wherein the central node is further configured to,

store values of the size of the discovery slot in a table with regard to different maximum numbers of undiscovered remote nodes that may transmit response messages; and

before sending out the solicitation message, retrieve value of the size of the discovery slot based on the current maximum number of undiscovered remote nodes that may transmit response messages.

25. The apparatus of claim 19, wherein size of the discovery slot is approximately:

$n \cdot T + \sqrt{n^2 \cdot T^2 + 2 \cdot T \cdot E \cdot (n-1)}$; where

T is the transmission busy time of the response message;

n is the maximum number of undiscovered remote nodes that may transmit response messages; and

E is the maximum round-trip propagation delay between the central node and any remote node.

26. The apparatus of claim 25, wherein the central node is further configured to

store values of the size of the discovery slot in a table based on different maximum numbers of undiscovered remote nodes that may transmit response messages; and

before sending out the solicitation message, retrieve value of the size of the response transmission period based on the current maximum number of undiscovered remote nodes that may transmit response messages.

27. A computer-readable storage medium storing instructions that when executed by a computer cause the computer to perform a method for

discovering remote nodes in an Ethernet passive optical network which includes a central node and at least one remote node, wherein downstream data from the central node is broadcast to the remote nodes, and wherein upstream data from each remote node is transmitted to the central node in a unicast manner, the method comprising:

receiving a solicitation message from the central node, wherein the solicitation message includes a time stamp indicating the solicitation message's transmission time and assigns a starting time and size for a discovery slot in which the remote node is allowed to transmit a response message to the central node for registration;

setting a local time at the remote node according to the received time stamp; and

after a random delay from the beginning of the discovery slot, transmitting the response message to the central node during the discovery slot with a response transmission probability that is less than or equal to one.

28. The computer-readable storage medium of claim 27, wherein the method further comprises setting the value of the response transmission probability according to how many times the remote node has failed in registering with the central node.

29. The computer-readable storage medium of claim 28, wherein the value of the response transmission probability is $C_f^{-(j-1)}$, where

j is the number previously failed registration attempts by the remote node; and

C_f is a positive number greater than 1.

30. The computer-readable storage medium of claim 27, wherein the central node sets the value of the response transmission probability and specifies the response transmission probability within the solicitation message.

31. The computer-readable storage medium of claim 30, wherein the method further comprises

setting the value of the response transmission probability according to the maximum number of undiscovered remote nodes that may transmit response messages for registration with the central node;

wherein the maximum number of undiscovered remote nodes that may transmit response messages decreases as the number of discovered remote nodes increases in an EPON with fixed maximum number of allowable remote nodes.

32. The computer-readable storage medium of claim 27, wherein the method further comprises

setting the size of the discovery slot according to the maximum number of undiscovered remote nodes that may transmit response messages for registration with the central node;

wherein the maximum number of undiscovered remote nodes that may transmit response messages decreases as the number of discovered remote nodes increases in an EPON with fixed maximum number of allowable remote nodes.

33. The computer-readable storage medium of claim 32, wherein the size of the discovery slot is proportional to the maximum number of undiscovered remote nodes that may transmit response messages, and is also proportional to transmission busy time of the response message.

34. The computer-readable storage medium of claim 33, wherein the size of the discovery slot is precisely or approximately equal to $C_s \times n \times T$, where

C_s is a positive number;

n is the maximum number of undiscovered remote nodes that may transmit response messages; and

T is the transmission busy time of the response message.

35. The computer-readable storage medium of claim 34, wherein the method further comprises

storing values of the size of the discovery slot in a table based on different maximum numbers of undiscovered remote nodes that may transmit response messages; and

before sending out the solicitation message, retrieving a value of the size of the discovery slot based on the current maximum number of undiscovered remote nodes that may transmit response messages.

36. The computer-readable storage medium of claim 32, wherein size of the discovery slot is approximately:

$$\frac{T \cdot (2n-1) + \sqrt{T^2 \cdot (2n-1)^2 + 8 \cdot T \cdot E \cdot (n-1)}}{2}$$; where

T is the transmission busy time of the response message;

n is the maximum number of undiscovered remote nodes that may transmit response messages; and

E is the maximum round-trip propagation delay between the central node and any remote node.

37. The computer-readable storage medium of claim 36, wherein the method further comprises

storing values of the size of the discovery slot in a table based on different maximum numbers of undiscovered remote nodes that may transmit response messages; and

before sending out the solicitation message, retrieving value of the size of the discovery slot based on the current maximum number of undiscovered remote nodes that may transmit response messages.

38. The computer-readable storage medium of claim 32, wherein size of the discovery slot is approximately:

$n \cdot T + \sqrt{n^2 \cdot T^2 + 2 \cdot T \cdot E \cdot (n-1)}$; where

T is the transmission busy time of the response message;

n is the maximum number of undiscovered remote nodes that may transmit response messages; and

E is the maximum round-trip propagation delay between the central node and any remote node.

39. The computer-readable storage medium of claim 38, wherein the method further comprises

storing values of the size of the discovery slot in a table based on different maximum numbers of undiscovered remote nodes that may transmit response messages; and

before sending out the solicitation message, retrieving value of the size of the response transmission period based on the current maximum number of undiscovered remote nodes that may transmit response messages.